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Case Report

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Anesthesia management in a pediatric patient with craniopharyngioma

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ABSTRACT

Craniopharyngiomas are the most common sellar or suprasellar tumors in childhood. The most critical issue in neuroanesthesia is ensuring adequate cerebral perfusion pressure and appropriate surgical conditions without altering autoregulation of cerebral circulation. The aim of this article is to provide an overview of anesthetic management for successful craniopharyngioma surgery in pediatric patients. An 11-year-old girl who presented to the pediatric outpatient clinic with complaints of headache and visual disturbances was diagnosed with craniopharyngioma, and transsphenoidal pituitary surgery was planned. Noninvasive monitoring (pulse oximetry, ECG, blood pressure, and temperature) was performed, and a precordial USG was prepared to detect air embolism. Mild to moderate hypothermia of 34-36°C was achieved. The patient had no intraoperative complications, was extubated postoperatively, and transferred to the intensive care unit for close monitoring. The goals of anesthesia for transsphenoidal pituitary surgery include optimizing cerebral oxygenation, maintaining hemodynamic stability, managing intraoperative complications, and facilitating rapid and smooth recovery.

Keywords: Craniopharyngioma, pituitary surgery, anesthetic management

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INTRODUCTION

Craniopharyngiomas are the most common sellar or suprasellar tumors in childhood. Because they grow slowly, they can become a huge mass if they are asymptomatic. Treatment should be personalized with a multidisciplinary approach. The goal of surgery should be total resection without mortality or acceptable morbidity.[1] The most critical issue in neuroanesthesia is ensuring adequate cerebral perfusion pressure and appropriate surgical conditions without altering autoregulation of the cerebral circulation. Successful surgical management of patients with pituitary tumors requires a multidisciplinary approach and depends critically on the quality of perioperative care. A thorough preoperative examination and screening are essential in all patients with pituitary tumors. Knowledge of potential complications, their management, and prevention strategies are essential for successful perioperative patient care. Ensuring the safety of premedication and preoperative sedation is of utmost importance in neurosurgical cases, particularly in pediatric patients who may experience separation anxiety from parents and fear of the operating room, which can complicate hemodynamic management. Hence, premedication should be administered with great care under the supervision of a physician, and the patient should be transported to the operating room expeditiously.[2] Effective surgical management of pituitary tumor patients is dependent on a multidisciplinary approach and the provision of high-quality perioperative care. This case report illuminates the anesthesia management of a successful craniopharyngioma case in the context of current literature.

CASE

An 11-year-old girl who presented to the pediatric outpatient clinic with complaints of headache and visual disturbances was diagnosed with craniopharyngioma and referred to us for preoperative anesthesia examination. Physical examination of the patient, which was performed preoperatively, revealed growth retardation and bitemporal hemianopsia. The patient's blood count, biochemistry and coagulation tests were within normal limits, and the level of thyroid hormones was low. The patient, with a GCS of 15, had no defect on cardiovascular examination. No respiratory pathology was detected in the patient. Thyroid hormone replacement and transsphenoidal pituitary surgery were planned for the patient, who had no surgical history and normal cortisol levels. Midazolam (0.04 mg/kg IM) was administered in the premedication room. The patient was transferred to the operating table. Noninvasive monitoring (pulse oximetry, ECG, blood

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pressure, and temperature monitoring) was performed. An urinary catheter was placed. A precordial USG was prepared to detect air embolism. The induction of mild to moderate hypothermia to a range of 34-36°C was achieved by employing cooling pads (Variotherm 680-Austria) and cooling the surrounding air. Rectal temperature measurements were utilized to monitor the patient's body temperature. Propofol (3 mg/kg IV) and fentanyl (1 mcg/kg) were used to induce anesthesia. After rocuronium (0.6 mg/kg IV), the patient was intubated and care was given with total intravenous anesthesia (TIVA) (remifentanyl 0.5 mcg/kg/min and propofol 75 mcg/kg/min). The patient was ventilated with maintenance 50% O_2-air inhalation. Subsequent to endotracheal intubation, an intra-arterial cannula was inserted to facilitate invasive blood pressure monitoring. Intermittent blood gas monitoring was performed. Mechanical ventilation was adjusted to maintain the end-tidal carbon dioxide level within a range of 35±1, which was confirmed via blood gas analysis. The isotonic crystalloid was preferred to the maintenance fluid. A 300 mg intravenous infusion of paracetamol (Partemol 1g/100 ml, VEM Drugs) was administered to the patient in the absence of any intraoperative complications to facilitate postoperative pain management. The cooling pads were removed once the patient's rectal body temperature had risen to 37.2°C, which was achieved by increasing the temperature of the pads towards the end of the procedure. The propofol infusion was ceased 10 minutes prior to the conclusion of the operation, while the remifentanil infusion was discontinued with the last skin suture. In addition, 100% oxygen was initiated. The patient was extubated after being decurarized with neostigmine (0.05 mg/kg) and atropine (0.02 mg/kg) postoperatively. The patient's hematocrit levels did not exhibit any alterations that necessitated intervention. The patient's postoperative pain level was assessed using a 10-point visual analog scale (VAS), while sedation was evaluated using the Aldrete scoring system at 0, 10, and 30 minutes. The patient, who had a VAS score of 3 and an Aldrete score of 8, received advanced care and advanced treatment for 1.5 hours after the operation before being transferred to the intensive care unit.

DISCUSSION

The local mass effect of the expanding intrasellar mass on adjacent structures can be observed in all types of pituitary tumors. Most commonly, visual loss occurs due to compression of the optic chiasm due to an adenoma. Intrasellar enlargement can cause anterior pituitary compression and dysfunction leading to hypopituitarism.[3] As with any expanding intracranial mass, patients may experience increased intracranial pressure (ICP). Although rare, patients with headaches accompanied by papilledema, nausea, and vomiting may have increased intracranial pressure. A pituitary tumor may increase ICP directly through the tumor itself or through third ventricle obstruction. If intracranial hypertension is suspected, it is important to avoid maneuvers that may further increase ICP. Preoperative administration of mannitol should be considered to decrease ICP. If the surgical plan includes placement of a lumbar intrathecal drain, the possibility of herniation should always be considered.[4]

Anesthesia for neurosurgical procedures in the pediatric age group is important for patients with a developing central nervous system (CNS). Age-related anatomical and physiological differences distinguish children from adults. Brain tumors in children are the most common solid malignancies. The location and histology of these tumors differ from those of adults.[5]

Compared with adults, there is a higher risk of morbidity and mortality, which may be related to perioperative cardiac and respiratory problems. For this reason, a good history and physical examination are essential before surgery.

Drug and food allergies in children must be thoroughly investigated. It should also be checked for the presence of diseases such as asthma and eczema and whether they have had previous surgery. In addition, findings due to existing cranial pathology should be known. The findings of increased intracranial pressure should be questioned.[2] Lethargy, seizures, cranial nerve involvement, and hormonal deficiencies of the pituitary axis may occur, especially in the presence of pituitary tumors (diabetes insipidus, syndrome of inappropiate secretion of antidiuretic hormone (SIADH), hypo- or hyperthyroidism, adrenal insufficiency, or hormone surges); nausea and vomiting should be questioned. It should be considered that nutritional problems may occur due to nausea and vomiting. Glasgow coma scale should be checked by neurologic examination in the preoperative period. The cardiovascular system should be thoroughly examined and it should be checked if there are shunts or defects such as atrial septal defect and ventricular septal defect. These pathologies alert us to the possibility of a fatal condition, such as air embolism. Because separation anxiety is high in children, premedication with oral or intravenous benzodiazepines may be considered.[6,7]

The goals of anesthesia for transsphenoidal pituitary surgery include optimizing cerebral oxygenation, maintaining hemodynamic stability, managing intraoperative complications, and facilitating rapid and smooth recovery. Invasive arterial monitoring can be necessary in patients with acromegaly or Cushing's disease and heart disease, as they may have significant hemodynamic changes. However, in acromegalic patients with carpal tunnel syndrome, ulnar artery compression can be a problem. These patients may have a "radial dominant" circulation, which means that the radial artery supplies more blood to the hand than the ulnar artery. This can increase the risk of complications from radial artery catheterization, such as ischemia or thrombosis, and should be considered when deciding on the most appropriate site for arterial cannulation.[8] The selection of anesthetic technique is contingent upon the patient's medical comorbidities and prior anesthetic experiences. Strategies that involve swiftly metabolized medications, such as propofol and remifentanil, or inhaled anesthetics with limited blood solubility, such as sevoflurane, may be appropriate to allow for a prompt neurological evaluation. The administration of inhaled anesthetic agents enhanced with remifentanil may confer increased hemodynamic stability and accelerate neurological examination.[9] The most critical situation during induction in these patients is to prevent an increase in intracranial pressure to avoid exacerbation of existing comorbidities. In the evaluation of the impact of inhaled anesthetics on the cerebral system,

the effects on intracranial pressure (ICP) and cerebral vascularity are typically assessed. Volatile anesthetics are recognized as potent cerebral vasodilators that increase cerebral blood flow. Furthermore, all volatile anesthetics diminish cerebral metabolic rate, with isoflurane exhibiting a more significant effect than halothane. Therefore, sevoflurane is the preferred inhaled anesthetic in patients undergoing neurosurgical procedures.[10] In this case, we preferred the combination of remifentanil and propofol for anesthesia maintenance. Studies evaluating the effects of remifentanil on ICP have shown that its administration leads to a reduction in ICP while causing minimal changes in cerebral perfusion pressure (CPP). Therefore, in the neurosurgery intensive care unit, the use of remifentanil is recommended to control ICP, treating high ICP cases that do not respond to propofol/mannitol treatment, and manage agitation that is unresponsive to standard treatments.[11] Transsphenoidal pituitary surgery is typically characterized by low intraoperative blood loss; nonetheless, there is a rare but potentially life-threatening risk of carotid artery injury during the procedure.[12] Maintaining muscle relaxation during the procedure is crucial to avoid any movement by the patient, which may result in CSF leakage, visual pathway injury, or vessel damage. In neuroanesthesia, the decision to administer blood transfusions should be carefully considered, taking into account the benefit/harm ratio of the blood and/or blood products to be administered to the patient. It is important to assess whether the patient actually requires a transfusion, which blood product to select, and the mode of administration. In neurosurgery cases, the target hematocrit level should typically be maintained between 30-33%.

According to a study by Ghahari et al., hypothermia has been recognized as an effective approach to mitigate brain injury resulting from various neurological insults.[13] The neuroprotective effects of mild hypothermia were well documented in experimental models.[14] In our case, mild hypothermia was employed. The use of moderate hypothermia, with body temperature lowered to 33-34°C, is generally acknowledged as neuroprotective against cerebral ischemic injuries while having few side effects. There exist studies that show that a one-hour duration to be enough to lessen neurological and functional deficits, as well as apoptosis in neurosurgical instances involving intraoperative hypothermia.[15]

Care should be taken during the intraoperative position to prevent air embolism, as this is a potential risk. Due to the peculiarities of the intraoperative situation, attention should be paid to the risk of air embolism.[16] Pituitary tumors may cause the syndrome of SIADH or cerebral salt wasting syndrome, and appropriate fluid maintenance and vasopressin dosages should be considered for treatment. Isotonic crystalloids are preferred as the ideal fluid, while hypertonic saline and mannitol can reduce intracranial pressure by drawing fluid from the interstitial and intracellular space into the intravascular space. However, its use in pediatric patients should be approached with caution.[17-19] Postoperative intensive care unit admission with close monitoring of all system parameters is recommended to manage complications such as regression of consciousness, airway obstruction, respiratory depression, cerebral edema, hydrocephalus, bleeding, seizures, tachycardia, hypotension, and hypertension. The most common hemodynamic problem observed is bradycardia.[20,21] Serum sodium osmolality and fluid electrolyte intake and output should be strictly monitored in patients with craniopharyngioma during the preoperative and postoperative periods. Good postoperative analgesia is essential, and opioids should be avoided due to their sedative effects on minute ventilation, which can lead to hypercapnia. Non-steroidal anti-inflammatory drugs (NSAIDs), steroids, and acetaminophen can be used for analgesia. Successful surgical management of patients with pituitary tumors depends on the quality of perioperative care. Pituitary tumors can cause diabetes insipidus, SIADH and cerebral salt wasting syndrome. They can be treated with an appropriate dose of fluid maintenance and vasopressin therapy. Isotonic fluids are preferred as the ideal fluid.

CONCLUSION

The goals of anesthesia for transsphenoidal pituitary surgery include optimizing cerebral oxygenation, maintaining hemodynamic stability, managing intraoperative complications, and facilitating rapid and smooth recovery.

ETHICAL DECLARATIONS

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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